

What is claimed is:

1. A filter press comprising:

a frame including an elongate rail structure;

first and second head assemblies supported on said rail structure adjacent respective opposite ends thereof, said head assemblies being relatively movable to permit opening and closing of said press;

a plate arrangement including a plurality of individual plates supported on said rail structure between said first and second head assemblies, said plurality of plates being disposed in a generally horizontally extending closed stack and clampingly held between said first and second head assemblies when said press is in a closed position;

said plurality of plates comprising a plurality of first plates each including a frame having a pair of oppositely disposed faces, a peripheral portion, and a central portion which is recessed inwardly with respect to said peripheral portion, a pair of liquid impermeable and flexible membranes fixed to said frame and extending across the respective opposite faces thereof to define respective pressure chambers between said central portion and the respective membranes; and

said plurality of plates comprising a plurality of second plates each including a frame having a pair of oppositely disposed faces, a peripheral portion, and a central portion, a pair of heat transfer members disposed within said central portion, said heat transfer members being disposed sidewardly inwardly relative to said peripheral portion of said second plate, said central portion of said second plate defining therein a chamber

which communicates with a supply of heated fluid and is disposed to bring the heated fluid within said chamber into contact with respective inner surfaces of said heat transfer members;

said first and second plates being disposed in an alternating manner along said rail structure in adjacent sealing contact with one another in said closed position of said press to define respective filter chambers therebetween for filtering and collecting solids from a slurry entering the respective filter chambers, each said filter chamber being defined on one side by a said membrane of a said first plate and on the opposite side by a said heat transfer member of a said second plate, and said pressure chambers communicating with a fluid source to expand said membranes of said first plates towards the respective adjacent second plates.

2. The filter press of Claim 1 wherein said second plates define therein a drainage passage which communicates with the respective filter chamber to permit drainage of the liquid portion of the slurry through said second plates.

3. The filter press of Claim 2 wherein said first plates define therein a drainage passage which communicates with the respective filter chamber to permit drainage of the liquid portion of the slurry through said first plates.

4. The filter press of Claim 1 wherein each said first plate mounts thereon a pair of liquid permeable filter members which overlie the respective membranes,

each said filter member and the respective adjacent membrane together defining a drainage chamber therebetween, and each said second plate mounts thereon a pair of liquid permeable filter members which overlie the respective heat transfer members, each said filter member of said second plates and the respective adjacent heat transfer member together defining a drainage chamber therebetween, each said first and second plate defining a passage therein in communication with the respective drainage chambers to permit drainage of the liquid portion of the slurry from opposite sides of the respective filter chambers.

5. The filter press of Claim 4 wherein each said heat transfer member defines therein a plurality of grooves which open toward the respective adjacent filter member to define a drainage surface across said heat transfer member.

6. The filter press of Claim 1 wherein said central portion of each said second plate defines thereon a pair of oppositely facing side surfaces, and said heat transfer members being respectively fixed to and overlying said oppositely facing side surfaces of said central portion of said second plate.

7. The filter press of Claim 1 wherein said central portion of each said second plate is hollow, and each said second plate comprises a heat transfer assembly disposed within said central portion and including said heat transfer members, said heat transfer members being sidewardly spaced from one another to define therebetween

said chamber for receiving heated fluid therein to heat said heat transfer members.

8. The filter press of Claim 1 wherein said heat transfer elements are constructed of metal, and said frame of each said second plate is constructed substantially of a non-metal material, such as plastic.

9. The filter press of Claim 1 wherein each said first plate mounts thereon a pair of liquid permeable filter members which overlie the respective membranes, each said filter member and the respective adjacent membrane together defining a drainage chamber therebetween, and each said second plate mounts thereon a pair of liquid permeable filter members which overlie the respective heat transfer members, each said filter member of said second plates and the respective adjacent heat transfer member together defining a drainage chamber therebetween, each said first and second plate defining porting therein including upper and lower ports, said upper and lower ports of said first plates being disposed diametrically opposite the respective lower and upper ports of the adjacent said second plate, said porting of said first and second plates communicating with the respective drainage chambers to permit drainage of the liquid portion of the slurry from the respective filter chambers.

10. The filter press of Claim 9 wherein said porting of said first and second plates additionally permits air blow through a filter cake disposed in a said filter chamber such that the air passes both transversely

across the width of the filter cake and longitudinally through the filter cake.

11. A filter press for separating liquid from a slurry, said press comprising:

a horizontally extending stack of plates disposed in side-by-side relation and supported on an elongate support frame which permits opening and closing of said stack, said plates being clampingly held together in sealed relationship with one another by said support frame to define a closed position of said press;

said stack of plates comprising first plates each including a rigid frame having a pair of oppositely disposed faces and being recessed inwardly on opposite sides thereof, said frame mounting thereon a pair of liquid permeable filter members which extend across the respective recesses of said frame to define respective drainage chambers, said stack further comprising second plates disposed in an alternating fashion with said first plates, each said second plate including a rigid frame having a pair of oppositely disposed faces and including thereon a pair of heat transmitting surfaces on respective opposite sides thereof, said heat transmitting surfaces being recessed inwardly relative to a peripheral portion of the respective second plate, the adjacent first and second plates together defining a filter chamber therebetween, and each said first and second plate defining ports therein in communication with the respective drainage and filter chambers to permit drainage of liquid from the slurry through both said first and second plates.

12. The press of Claim 11 wherein said frame of each said second plate includes a central wall having opposite sides on which the respective heat transmitting surfaces are defined, said central wall defining therein heating passages disposed to conduct heated fluid along the respective heat transmitting surfaces to heat same and a filter cake formed in the respective filter chamber.

13. The press of Claim 11 wherein said frame of each said first plate includes a central portion surrounded by a peripheral portion, said central portion being recessed inwardly relative to said peripheral portion, each said first plate mounting thereon a pair of liquid impermeable membranes each disposed between said central portion and a respective said filter member, each said membrane and said central portion together defining a pressure chamber therebetween for receiving pressurized fluid to expand said membrane towards the respective second plate.

14. The press of Claim 11 wherein each said second plate mounts thereon a pair of liquid permeable filter members which overlie the respective heat transmitting surfaces, each said second plate defining a drainage chamber between each said filter member and the adjacent heat transmitting surface, and each said heat transmitting surface defining therein drainage grooves which open towards the respective filter member.

15. A plate for a filter press for separating liquid from a slurry, said plate comprising:

a rigid frame including a peripheral portion disposed in surrounding relation with a central portion, said central portion having a width which is less than said peripheral portion such that inwardly projecting recesses are respectively defined on opposite sides of said frame; and

a pair of heat transfer elements disposed on opposite sides of said frame and within the respective recesses, each said heat transfer element comprising an outer peripheral portion fixed to said frame and defining a flexible bellows, and a metal heat plate fixed to an inner edge of said bellows and extending across the respective recess of said frame, each side of said central portion and the adjacent said heat transfer element together defining a chamber which communicates with a supply of heated fluid to provide intimate contact between the heated fluid and an inner surface of the respective heat plate.

16. The filter plate of Claim 15 wherein said frame defines therein a flow passage arrangement which communicates with respective filtrate chambers defined at respective outwardly facing side surfaces of said heat transfer elements, said flow passage arrangement additionally communicating with a liquid discharge conduit to permit drainage of liquid from the slurry through said plate.

17. A plate for a filter press for separating liquid from a slurry, said plate comprising:

a frame including an outer peripheral portion disposed in surrounding relation with a central portion,

said frame being constructed of a material having a low heat conductivity, said central portion having oppositely facing sides which are recessed sidewardly inwardly relative to said peripheral portion; and

a pair of heat plates fixed to the respective sides of said central portion so as to overlies same, said heat plates being disposed sidewardly inwardly relative to said peripheral portion so as to define part of a filtration chamber when disposed adjacent another filter press plate, said sides of said central portion of said frame defining therein flow passages which receive heated fluid and transport the heated fluid into intimate contact with the respective said heat plates to heat same.

18. The plate of Claim 17 wherein said plate defines therein a port arrangement which communicates with the respective filtration chambers to permit drainage of liquid portion of the slurry through said plate and to permit air blow of cakes formed in the respective filtration chambers to dry same.

19. The plate of Claim 18 wherein each said heat plate defines thereon an irregular surface to prevent sticking of the filter cake thereto and to provide a drainage area for liquid portion of the slurry.

20. The plate of Claim 19 wherein said irregular surface comprises a plurality of grooves which open sidewardly towards the respective filtration chamber.